



LightMAT & DataHUB Overview

Darrell Herling, Co-Director LightMAT
Pacific Northwest National Laboratory



U.S. DEPARTMENT OF
ENERGY

National Laboratory
Impact Initiative



EMN

Energy
Materials
Network

Project ID # MAT140

April 25, 2018

Overview

Timeline

- Project Start: Oct, 2015
- Project End: Open
- Percent Complete: N/A

Budget

- Total Project Funding
 - DOE Share: \$8.68M (ITD)
 - Participant Share: \$3.45M (CRADA in-kind commitments)

Barriers

- Limited available R&D resources available to apply towards achieving 25% mass reduction of glider by 2025
- Various technical challenges associated with enabling multi-material vehicles

Partners

- DOE-VTO and FCTO
- 11 National Laboratories
- 14 Company participants
- 4 Universities (through CA contributions)

LightMAT Relevance



Energy Materials Network

U.S. Department of Energy

Established as part of the Energy Materials Network, under the U.S. Department of Energy's Clean Energy Manufacturing Initiative, the mission of the Lightweight Materials National Lab Consortium is to create an enduring national lab-based network, enabling industry to utilize the national labs' unique capabilities related to lightweight materials.

Promote and support lightweight materials research and development for energy-efficiency applications, through workshops, industry outreach, network assessments, and technical assistance to industry partners.

Relevance: Four Pillars of LightMAT

➤ WORLD CLASS MATERIALS NETWORK (Capability Catalog)

Create and manage a resource network comprised of capabilities from across the DOE National Laboratory system.

➤ CLEAR POINT OF ENGAGEMENT (Concierge)

Provide a single point-of-contact and concierge to connect industry research teams engaged in lightweight materials R&D to the resource network.

➤ DATA AND TOOL COLLABORATION FRAMEWORK (DataHUB)

Establish a data repository to aid in accelerated learning and development through data-driven analytics and collaborative tools.

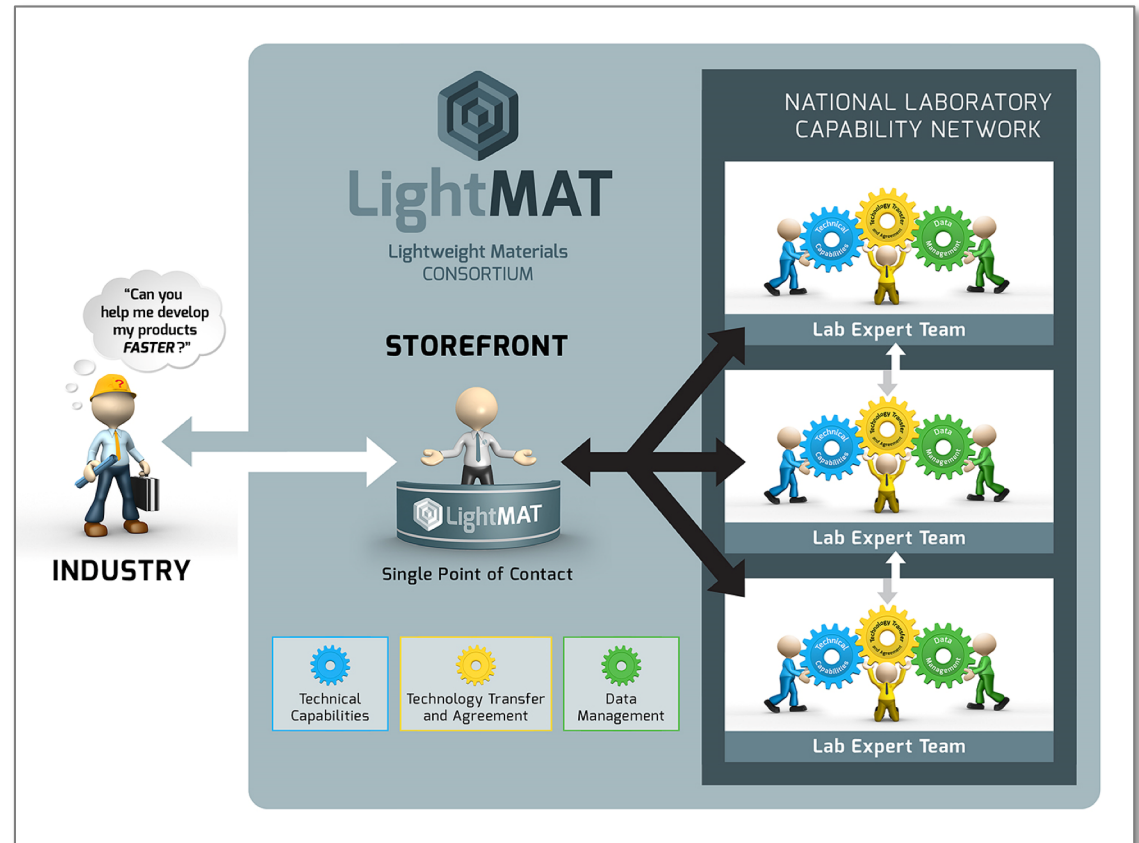
➤ STREAMLINED ACCESS (Standard Contracting Agreements)

Facilitate rapid partnerships, assistance agreements, access to intellectual property, and aggressively pursue approaches to reduce non-technical barriers.

Approach: LightMAT – Lightweight Materials Consortium

Program Objectives:

- Facilitate connection between Industry needs & National Lab capabilities
- Create an enduring, coordinated national capability network
- Accelerate lightweight materials development & deployment in the U.S.



Creating an enduring national laboratory network, enabling industry to utilize the laboratories' unique capabilities related to lightweight materials.

Approach: Partnering with Industry via FOAs and CRADAs

1

➤ Funding Opportunity Announcement (FOA)

- DOE program announces
- Flexibility to allow other federal programs/entities to co-sponsor LightMAT
- LightMAT assistance made available for specific topics as identified in FOA

2

➤ DOE Directed Funding Assistance (DFA)

- Guided topics and attributes of appropriate direct funded projects
- Industry partner(s) approach LightMAT and develop project concept with lab(s)
- Industry identifies critical research needs through CRADA call

3

➤ Industry direct contract funded research

- Industry partner defines research need, topic and scope of work
- LightMAT resources funded by 100% by industry
- Open opportunity any time

Accomplishments: World Class Materials Network

- Capability catalog listing of lightweight metals and composites in place at: <https://lightmat.org>
- Network is continuously expanded to support a broader selection of LW materials capabilities



Home » Capabilities

LightMAT Capabilities

The LightMAT resource network contains capabilities from the U.S. Department of Energy National Laboratory system. This search function enables you to view and filter these capabilities within LightMAT.

Many of the capabilities listed on this page are user facilities managed by the U.S. Department of Energy's Office of Science. Each user facility has established processes for submitting a proposal and gaining access. Visit <http://science.energy.gov/user-facilities/user-resources/getting-started> for more information.

Capability	National Lab	Description
Tribological Testing and Modeling	Oak Ridge National Laboratory	Oak Ridge National Laboratory is a national leader in tribological research and development (R...
Transport and Thermophysical Properties	Oak Ridge National Laboratory	Oak Ridge National Laboratory provides world-class facilities and a staff of technical experts for determining transport and thermophysical properties, such as thermal conductivity, diffusivity,...
Prediction of Corrosion Resistance and Component Life With and Without Protective Coatings	Pacific Northwest National Laboratory	Pacific Northwest National Laboratory offers an integrated experimental/modeling capability that predicts oxide-scale (without coating) or subscale (with coating) growth, characterizes scale/coating...
Atom Probe Tomography (Cameca LEAP 3000)	Sandia National Laboratories	The Cameca LEAP 3000 atom probe is a voltage-pulsed instrument that allows three-dimensional atomic characterization of metals.
Enhanced Understanding and Expertise of Structural Defects In Metals	Sandia National Laboratories	Sandia National Laboratories' staff have the experience and expertise in investigating the mechanisms governing strain localization and dislocation transmission at interfaces of metals. This includes...
Finite Element Tools and Simulations Connecting Properties to Performance	Sandia National Laboratories	Fundamental consideration of finite deformation mechanics within the context of nonlinear finite element methodologies integrated with constitutive model domain expertise provides a path to material...
Multiscale Process Modeling of Bulk Nanolaminates	Los Alamos National Laboratory	Computational models at Los Alamos National Laboratory can help guide the design of processing pathways for making stable bulk nanolaminate microstructures with tailored properties. The current model...
Predicting the Formability of Lightweight Alloys	Pacific Northwest National Laboratory	Researchers at Pacific Northwest National Laboratory have demonstrated experience in predicting formability of lightweight alloys, including magnesium sheet. A heated limiting dome height (LDH)...
Dynamic Transmission Electron Microscope	Lawrence Livermore National Laboratory	The Dynamic Transmission Electron Microscope, or DTEM, is a unique in situ electron microscope at Lawrence Livermore National Laboratory that is designed to observe fast materials processes at the...

Reset Filters

Currently Matching 89 Results

Search Capabilities

Enter capability search terms **Search**

National Laboratory

- ☐ Pacific Northwest National Laboratory (24)
- ☐ Oak Ridge National Laboratory (19)
- ☐ Sandia National Laboratories (15)
- ☐ Lawrence Livermore National Laboratory (9)
- ☐ Los Alamos National Laboratory (9)
- ☐ National Renewable Energy Laboratory (6)
- ☐ Ames Laboratory (3)
- ☐ Idaho National Laboratory (3)
- ☐ Argonne National Laboratory (2)

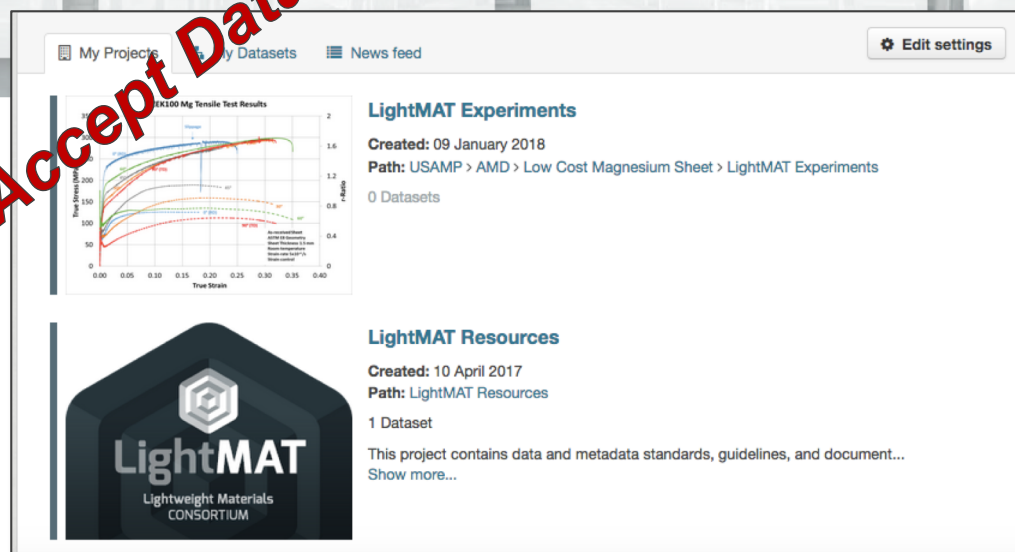
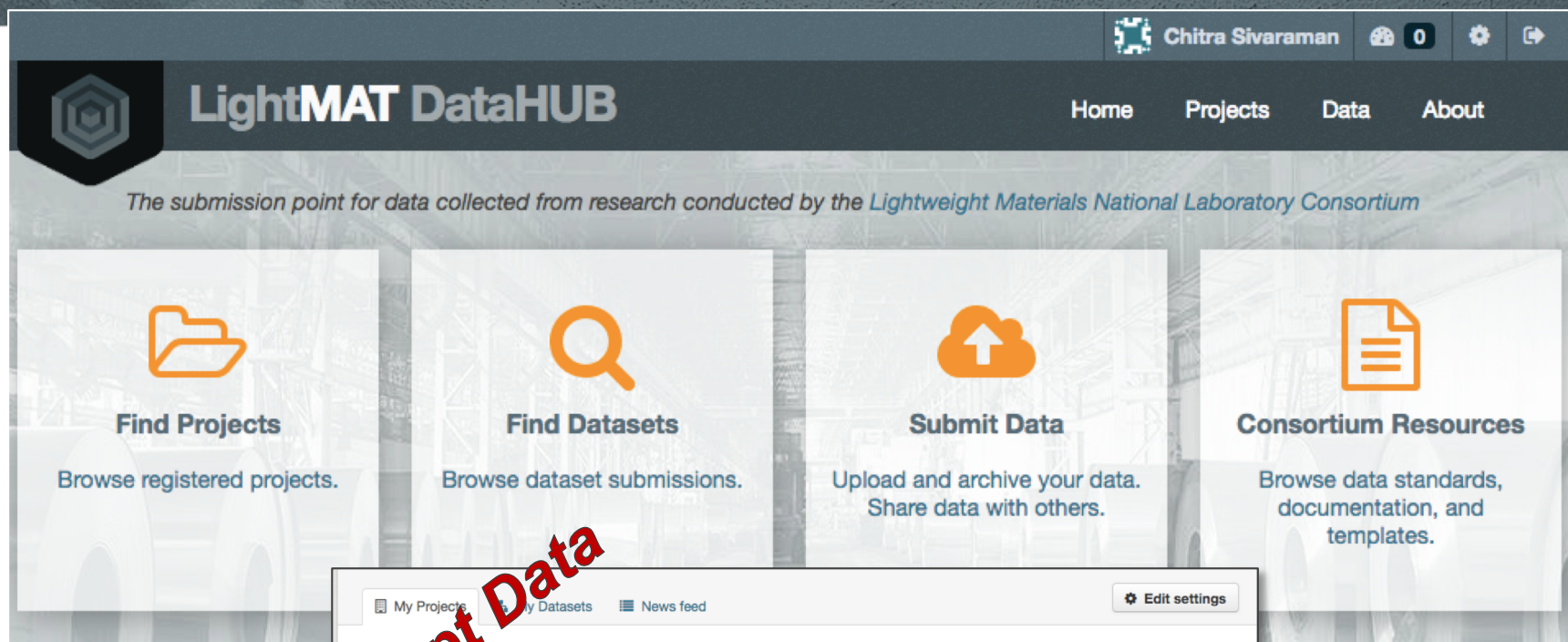
Characterization

- ☐ Mechanical Behavior of Materials (27)
- ☐ Extreme Environment Testing (20)
- ☐ Microscopy (18)
- ☐ Non-destructive examination (7)

Computational Tools

- ☐ Structure-Properties (12)

Accomplishments: DataHUB Capabilities



- Collect,
- Store,
- Preserve,
- Disseminate Data

Accomplishments: LightMAT by the Numbers



\$3.5M

Private Partner
Cost-share

29%

\$8.6M

Federal Dollars
Invested

71%



Reducing Vehicle Mass by **10%**
Increases Fuel Economy by **7%**



11
National
Laboratories



14
Partner
Organizations



142
Cross Network
Capabilities



13
Total
Projects

Responses to Previous Years Reviewers' Comments

- LightMAT has not been reviewed previously
- LightMAT assisted projects reviewed at this year's 2018 AMR
 - FOAs: Tuesday 19-June
 - MAT124 – *UVA; ICME for Low-Cost Carbon Fiber*
 - MAT127 – *USAMP; Low-cost Mg Sheet Component*
 - DFA Round #1: Wednesday 20-June
 - MAT142 – *Arconic; MMC Brakes using TiB2*
 - MAT143 – *Magna; Mitigation of Mg Corrosion*
 - MAT144 – *ArcelorMittal/Diversitak; AHSS with CFRE*

Collaboration and Coordination

Member Labs

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency &
Renewable Energy
VEHICLE TECHNOLOGIES OFFICE



Sandia
National
Laboratories



Participants



ArcelorMittal



sapa:



Proposed Future Work

DFA #3 open opportunity: June 20, 2018

Anticipated # of project selections:

5 @ \leq \$500k DOE share + matching in-kind

White papers application due: July 31, 2018

Selection decisions by: August 31, 2018

Projects kick-off target: October 1, 2018

- Technology licensing and transfer activities
- DataHUB evolution



Note: project concept white paper template and criteria available at <http://LightMAT.org> or by contacting the LightMAT Concierge

Any proposed future work is subject to change based on funding levels

Summary

Contact Information

email:

contact@LightMat.org

phone:

(509)375-3822

web:

<http://LightMat.org>

ABOUT CAPABILITIES NEWS PARTNERSHIPS FUNDING OPPORTUNITIES

LightMAT
Lightweight Materials
CONSORTIUM

Access to the Department of Energy's national laboratory capabilities will further development of lightweight materials technologies, constituting another step toward meeting Vehicle Technologies Office program objectives. Five American-based organizations will receive \$2.25 million in technical assistance from Pacific Northwest National Laboratory, Sandia National Laboratories, Oak Ridge National Laboratory, and Los Alamos National Laboratory.

Characterization	Computational Tools	Processing/Manufacturing
Extreme Environment Testing Evaluation of materials in environmental, chemical, electrical and mechanical combined conditions	Data Tools Materials data mining, discovery, information management, and analysis tools	Fabrication & Synthesis Material development across scales from synthesis to scalable production
Mechanical Behavior of Materials Evaluation of mechanical performance across strain rates, surface conditions, and geometric constraints	Materials Processing Predictive simulation capabilities for deformation, joining, solidification	Joining Advanced joining development including multi-material, solid-state, fusion and fastening
Microscopy Visualization & characterization techniques ranging from advanced optical to x-ray and beam specific equipment	Process-Structure Mechanism based process to structure prediction	Shaping & Forming Evaluation of materials formability limitations, rate sensitivity, tool life, and effects of shaping
Non-destructive Examination Methodologies for evaluation of properties, processes, and materials without destructive testing	Structure-Properties Continuum or discrete prediction of effective properties	Thermo-mechanical Processing Development of heat treatments, thermo-mechanical processing, and microstructural modification techniques

Technical Backup Slides

EXAMPLE OF DFA CRADA CALL DETAILS

LightMAT DFA#2 CRADA Call

Open opportunity: Sept. 25, 2017

Anticipated # of project selections: 5 @ \leq \$500k each

White papers application due: November 6, 2017

Selection decisions by: December 22, 2017

Projects kick-off target: February 12, 2018

Note: project concept white paper template and criteria available at <http://LightMAT.org> or by contacting the LightMAT Concierge.

DFA #2: Topic Focus

Topic 1: High Rate Processing of Carbon Fiber Composites

1 – 3 awards of \$500,000 each anticipated

- Develop methods to produce low-cost, high-volume carbon fiber composite components suitable for automotive applications.
- Performance target: Net-shape manufacturing cycle time < 3 minutes, having composite tensile strength ≥ 700 MPa (100 ksi), and composite tensile modulus ≥ 100 GPa (14 Msi).

Topic 2: Design for Dissimilar Material Joints

1 – 3 awards of \$500,000 each anticipated

- To increase the use of diverse lightweight materials, it is necessary to understand the unique relationships that exist between joining methods, process parameters, component designs, and substrate materials properties.
- Create design guides and tools to predict performance of specific process technologies for joining dissimilar materials that will significantly reduce the time-to-market for lightweight multi-material structures.

Topic 3: Industry Challenges in Lightweighting

1 – 2 awards of \$500,000 anticipated

- This topic provides an opportunity for industry to identify pressing research and development needs for specific technology applications that will enable the rapid implementation of lightweight materials in vehicles.

Application & Selection Process

1. Industry partner approaches LightMAT concierge or member national laboratory for matching needs to capabilities
2. Industry develops project concept white paper (template & criteria available on website) and submits by the application deadline
3. LightMAT reviews qualifications, scores criteria, and ranks applications
4. LightMAT notifies industry partner of selection and routes CRADA and NDA agreements for signature
5. Partnership begins with CRADA approval by DOE

Who is Eligible

- All U.S. domestic companies serving the automotive market, large or small, are able to seek assistance and use the strategic resources of LightMAT to accelerate lightweight materials research and development.
- U.S. incorporated subsidiaries with a foreign-owned parent company, are eligible to apply.
 - A waiver request will be required.
 - All projects under this DFA must perform 100% of all work in the United States (100% of all direct labor).

DFA and Project Requirements

- Qualifying scope must be related to lightweighting of vehicle structures through materials or process technologies, and within the topic focus areas specified by the DFA CRADA call.
- Total duration will be less than or equal to 2 years
- Industry contributions (cash and/or in-kind) will be greater than or equal to 50% of the total project cost
- DOE funding designated for DOE member national laboratories only
 - Subcontracting using DOE funds is not allowed
- Total DOE share per project will be less than or equal to \$500,000

Application Review Criteria

Reviewed and ranked against established criteria, aligning with LightMAT objectives

Scoring assigned between 1 and 10, reflecting whether the white paper makes clear and compelling case



	Weight
Review Criteria 1: Impact on Vehicle Weight Reduction	
If successfully developed and deployed, the proposed technology significantly and directly reduces weight of on-highway vehicles;	15%
Extent to which the proposed innovative technology is consistent with the objectives and achievement of prescribed goals, targets, or metrics as described in the topic description;	10%
Extent to which the approach comprehensively and logically addresses research, development, validation, demonstration activities, risks, and risk mitigation strategies;	15%
Review Criteria 2: Appropriateness of Government Funding	
Government investment is required, and the private sector cannot or will not invest;	10%
Resources are NOT available outside of the LightMAT network that industry can access to achieve a comparable result;	10%
Access to LightMAT resources offers a substantial (~2x) acceleration towards meeting the project objectives when compared to the same project without access to LightMAT;	15%
Review Criteria 3: Opportunity for Market Impact	
The lightweight technology is targeted towards a specific application in a defined system;	15%
There is market demand for the improved material or process technology and there is a clear pathway described for transition to the market, with appropriate supply-chain identified.	10%

DFA#2: Schedule

Date	Event
Sept. 25 th	Public announcement for DFA#2
Oct 10 th	Webinar about LightMAT and DFA#2 opportunity
Nov 6 th	White Paper submission deadline (3:00 pm ET)
Dec 22 nd	Notifications of selected projects
Jan 2 nd , 2018	CRADA contract initiation for selected projects
Jan 5 th , 2018	Public announcement of project selections
Feb 12 th , 2018	Project kickoff target (pending CRADA approval)

Details to emphasize

- Topics must align with DFA call and application for materials lightweighting of rolling vehicle structure (a.k.a. gilder)
- All projects will be managed as a CRADA
 - CRADA and NDA agreements are non-negotiable
 - Industry must provide the CRADA Annex details
 - National Lab(s) provide a statement of work (SOW) covering their scope using the LightMAT template
- Projects are subject to DOE review and reporting requests
 - Annual merit reviews
 - DataHUB input
- Foreign company ownership requires additional review and approvals